pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SHIPMENT OF TECHNOLOGICALLY ENHANCED NATURALLY OCCURRING RADIOACTIVE MATERIAL UNDER THE U.S. DOT HAZARDOUS MATERIAL TRANSPORTATION REGULATIONS

Safe and proper shipment of radioactive materials occurs frequently on the roads of Pennsylvania. This includes nuclear medicine, industrial equipment and manufacturing byproducts. This fact sheet focuses on the shipment of technologically enhanced naturally occurring radioactive material (TENORM).

Most soils and rocks contain low-levels of naturally occurring radioactive material (NORM). Often this NORM is concentrated through physical or chemical processing resulting in technologically enhanced NORM called TENORM. Examples of TENORM-containing materials include fire brick, water and waste water treatment residuals, coal ash and decorative polished rock commonly used in building or home construction. It is also common for the native rock strata worked on by the oil and gas (O&G) extraction industry to contain somewhat higher levels of NORM, specifically natural uranium, thorium and their decay products. Consequently, sediment and solid filter cakes resulting from the recycling or processing of "produced water" (e.g., brines or flowback) typically have increased concentrations of TENORM.

This fact sheet is intended to alert generators of TENORM-containing material in all industry sectors that, at high concentrations, the TENORM may be classified as a hazardous material as defined by the United States Department of Transportation (USDOT). The USDOT has regulatory authority and responsibility for safety in the transportation of all hazardous materials, including radioactive material. The USDOT has nine hazardous material classifications, with "radioactive material" being Class 7.

REGULATION

It is important to note that this fact sheet is not intended to provide complete guidance on the packaging and shipment of radioactive material under USDOT Hazardous Materials Regulations (HMR) contained in Title 49, Code of Federal Regulations (49 CFR) Parts 100–178. However, the first step when moving hazardous materials is to determine if the levels of TENORM meet the USDOT HMR definition of Class 7 "radioactive material," as defined in 49 CFR 173.436. In the case of radium-226 (Ra-226), for example, any shipment that is offered for transport in commerce, and has an Ra-226 concentration greater than 270 picocuries per gram, and has a total activity above 0.27 microcuries would be subject to the USDOT HMR regulations. If those thresholds are met, then the other USDOT HMR regulations related to proper shipment name (e.g., low specific activity), manifesting as hazardous material on shipping papers, proper packaging and marking and placarding as "radioactive" must be evaluated and implemented.

TENORM EVALUATION

In addition to radiological concentration and total activity data, the physical characteristics of the material must be determined if there is more than one hazard class material. Further, if the TENORM (e.g., Ra-226) in the waste has been fully identified by proper sampling and radiochemistry, and one wishes to continuously ship based on indirectly measuring external gamma radiation fields from the waste load, then one needs to know the state of equilibrium between the Ra-226 and respective decay products that will build up over approximately 25 days. It is the responsibility of each person who offers a hazardous material for transportation in commerce to develop methods of sampling, testing and monitoring TENORM in product or waste. This may require a series of sampling radiochemistry laboratory tests and routine exposure rate measurements from the shipping package to determine if the upper limit of activity and concentration are exceeded. If high concentrations of TENORM are expected from a process, DEP recommends that a qualified USDOT HMR shipper be engaged to evaluate the TENORM content for shipping.

USDOT HMR Class 7 "Radioactive" Placard

Reference: USDOT regulations online at http://www.phmsa.dot.gov/regulations

For regulatory questions about the shipment of natural material, ores or hazardous material transportation requirements, contact:

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For more information, visit www.dep.state.pa.us, keyword: Radiation Protection.